Amendments to the Drawings

Please amend Figure 17 as indicated in red in the accompanying copy of that drawing. An amended sheet of drawings is attached.

REMARKS

The present response is filed within two months of the mailing date of the final Office Action.

In response to the Office Action issued March 1, 2006, the Applicants firstly note that the claims originally on file contained the same limitations as presently found in claim 43 through 54 by requiring the convex abutments to roll across the motors as the swashplate is adjusted. Language added in the previous amendment simply clarified that recitation and as such it is believed that it is not a new issue or limitation to be considered by the Examiner.

The Examiner has rejected claims 1, 2, 4, 5, 12 and 14 through 16 under 35 USC 102(b) as being anticipated by the Thoma reference. The Examiner's position seems to be that the representation of the pressure compensated flow control valve in Figure 17 is that of a throttle valve and therefore the two are equivalent. However, it appears that the Examiner has ignored the showing in Figure 17 of the pilot line operating on the throttle valve which is standard schematic notation for a pressure compensating flow control valve. It is acknowledged that the pilot line was inadvertently omitted from one of the valves and a drawing correction is submitted to correct this. However, the description at paragraph 56 clearly describes the function of the valves 168 as one in which the fluid supply is constant and the description of the operation at paragraph 69 in which the ability to maintain a constant flow under varying pressure is set forth. Clearly therefore the valves 168 are not simply throttle valves but are in fact a different type of valve known as a pressure compensated flow control valve, as recited in the claim.

Thoma shows a fixed orifice with a constant cross section groove providing a by-pass flow around a check valve. The characteristics of such a fixed orifice are entirely different to those of a pressure compensated flow control valve. As indicated in Figure A below which is exerts taken from a catalogue of HydraForce, a well known hydraulic component supplier, the flow rate through a simple throttle valve increases with pressure and is non-linear. This is shown by the different curves a, b, c and d representing different orifice sizes.

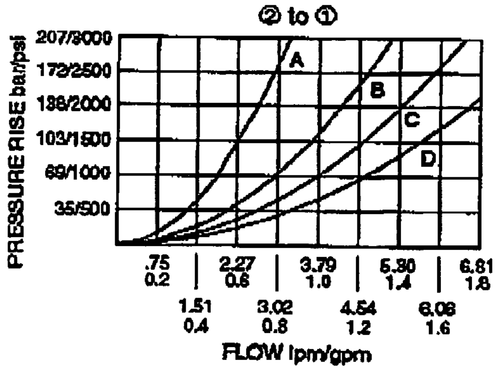

FIG. A

PERFORMANCE (Cartridge Only)

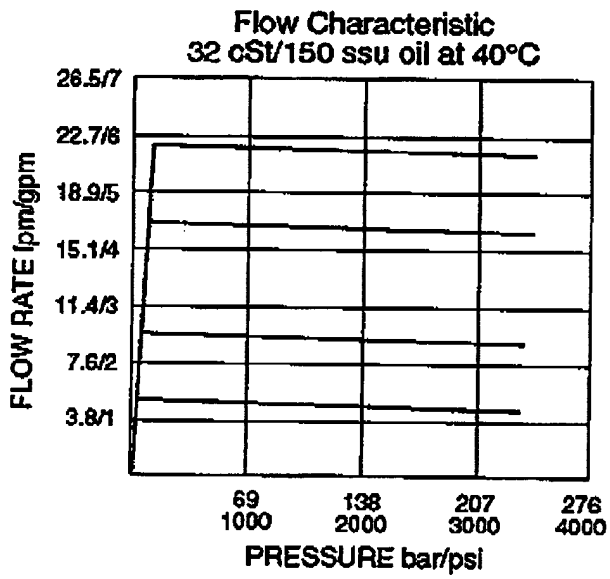

FIG. B

By contrast, the characteristics of a pressure compensated flow control valve as shown in Figure B above are such that the flow rate changes very minimally over the entire pressure rating range. The Figure B below shows the response at four different settings of the pressure compensated flow control valve and it will be seen that a nearly linear flow rate is maintained as the pressure varies above a nominal pressure to full

operating pressure. Accordingly, it is believed apparent that the showing in Thoma does not constitute a pressure compensated flow control valve and does not provide the attributes specifically set forth in the specification for such a valve. As such Thoma does not anticipate claim 1 and the claims dependent thereon under 35 USC 102(b).

The difference in the characteristics of the valves and the particular environment claimed is significant.

The Thoma patent relies on a fixed orifice for pressurizing the swashplate cavities. Assume that a perfect hydrostatic balance was achieved (via the orifice DN) at some specific pressure (e.g. 5000 PSI) and there is sufficient under-balance to bias the swashplate toward the bearing surface appropriately. As soon as the swashplate rotates, the area requiring balance changes along with the resultant forces and balance is lost. Either the under-balance is too severe causing contact between the swashplate and the bearing, or it becomes over-balanced and vents this flow to the case causing system malfunction. Also, when system pressure changes so does the balancing force. This is assumed to be proportional to piston forces based on the same system pressure. However, due to variations in bearing gap, this is not true. Therefore, today's systems are hydrostatically "lubricating" the bearings rather than producing a true hydrostatic "balance."

With the Thoma reference, the flow supplied to the bearing would vary with the system pressure, assuming that there is no pressure in the fluid between the swashplate and the bearing surface. However, high system pressure implies a high load such that the fluid retained between the bearing surfaces will also be under a high hydrostatic pressure. Under those conditions, the pressure differential across the orifice is minimal and therefore no flow will be produced. Similarly, under a condition of high system pressure but minimal load, such as when the swashplate is at neutral but holding maximum system pressure, a maximum flow rate of fluid will be obtained as the pressure differential across the orifice is maximum. This is entirely the opposite to what is required and when added to the non linearity of the operating conditions of the system will be appreciated that it fails to address the practical needs of this particular environment.

By contrast, the provision of the pressure compensated flow control valves provides a continuous flow of fluid regardless of the system pressure so that the film thickness between the swashplate and the bearing surface is indifferent to system pressure fluctuations. The interface between the swashplate and the housing acts in a manner similar to a relief valve since a constant flow is being provided through the function of the pressure compensated flow control valves. This constant flow must escape and therefore supports the swashplate at all times.

Claim 1 therefore clearly distinguishes over the Thoma reference by reciting the provision of pressure compensated flow control valves which have a well defined characteristic as recited in claim 1 as maintaining a predetermined flow as pressure varies and which are fully described in the specification. Thoma does not teach such a valve and does not elude to any operating characteristics that would suggest such a valve. Thoma therefore cannot and does not anticipate claim 1 and the claims dependent thereon.

The Examiner has also rejected claims 1, 2, 4, 5, 12, 14 to 17 and 20 to 24 under 35 USC 103. In this rejection, the Examiner has relied upon the reference to Damtrew in combination with Thoma. The Examiner acknowledges that Damtrew does not show the source of fluid of the fluid bearings and relies upon Thoma to teach such a feature. However, as noted above, Thoma does not teach the use of pressure compensated flow control valves and therefore the combination of Damtrew and Thoma fail to teach the invention claimed in claim 1 and the claims dependent thereon. Claim 1 and the claims dependent thereon are therefore believed to clearly and patentably distinguish over the combination of references applied by the Examiner and as such are condition for allowance.

Similarly considerations apply with respect to claims 7 through 11 and 13 which are rejected under 35 USC 103 over Damtrew in view of Thoma and further in view of Jepsen. The Examiner relies upon Thoma to teach the provision of the pressure compensated flow control valve recited in claim 1 from which claims 7 through 11 and 13 depend. However, as discussed above, Thoma does not teach such a feature and

therefore the combination of Damtrew, Thoma and Jepsen fail to teach what is claimed in claims 7 through 11 and 13. It should also be noted that Jepsen does not teach the provision of a coated bearing surface between the swashplate and the housing that is used in combination with hydraulic fluid. Jepsen teaches the provision of a plastic liner in the ball joint between the piston and the shoe but it does not utilize hydraulic fluid as a material bearing element. Rather, as set out at column 4, line 32 it takes advantage of the fluid as a cooling medium and to relieve hydrostatic pressure that may be build up as the piston and shoe articulate. However, as note above, even taking the Examiners position with respect to Jepsen, there is no teaching in any reference of the provision of pressure compensated fluid control valve as required in claims 7 through 11 and 13.

The Examiner has rejected claims 43 through 47, 53 and 54 as unpatentable over Damtrew in view of Blasutta. Claim 43 requires the positioning of the convex abutment on the planar face to be such that the abutment roll across the end face of the motors as the swashplate is adjusted so as to prevent relevant sliding motion between them. It is noted that there is a typographical error in the amendment previously submitted in that the "end faces" should refer to "convex abutments" in the third from last line but it is believed that the claim was read as reciting the convex abutments in view of the nature of the Examiners rejection.

Blasutta does not teach the provision of the rolling engagement between the abutments and the end face of the motors. Blasutta specifically provides a pin and roller that will allow relative rotation as the swashplate is adjusted. There is therefore, as shown in Blasutta, a sliding motion between the pin and the roller as such adjustment occurs. Moreover, such motion can only occur if there is relative translation between the end face of the motor and the outer face of the abutment. It is this translation that is accommodated in the sliding motion around the pin.

By contrast, the invention as claimed in claim 43 requires the disposition of the convex abutment and the planar face such that the convex abutments roll across the end face of the motors. In such an arrangement there is no relative sliding movement which induces rotation of the convex abutment. It is the rolling motion that avoids the need for a roller arrangement as shown in Blasutta. Blasutta therefore inherently does

not have such an arrangement and does note teach or suggest such an arrangement.

The provision of the rolling motion across the end face has significant advantages in terms of the performance of the hydraulic machine. The construction of the swashplate is significantly simplified and the mass of components and therefore the inertia of the swashplate are reduced. This allows a faster response time which is a highly desirable characteristic of such a hydraulic machine. Moreover, any play that would inherently occur between the roller arrangements as shown in Blasutta has been eliminated allowing further close control of the swashplate by the motors. The play inherent in any roller arrangement would lead to imprecision of the swashplate and undesirable movement given the varying loads that are placed on the swashplate in normal operation. This is avoided in the simple but elegant arrangement set out in the present application in which the positioning of the abutment and the end face avoids the needs for such a bearing arrangement. Accordingly, it is believed that claim 43 and the claims dependent thereon clearly differentiate over the combination of Damtrew and Blasutta as applied by the Examiner and are in condition for allowance.

The Examiner has also applied the referent to Jepsen to claims 48 through 52 that depend directly or indirectly upon claim 43. In so far as the Jepsen reference does not disclose the rolling contact set forth in claim 53, it is believed that these claims also distinguish over the combination of art applied by the Examiner.

The Examiner has rejected claims 18 and 19 under 35 USC 103 in view of a combination of Damtrew and Okuda. It is noted that claims 18 and 19 depend indirectly from claim 1 and as such require the provision of the pressure compensated flow control valves. The Examiner has acknowledged that Damtrew fails to disclose such structure and it is not seen where Okuda provides such a structure. Accordingly, the combination of Damtrew and Okuda does not teach the subject matter recited in claims 18 and 19 in that there is no provision for pressure compensated flow control valves.

In so far as the Applicants believe that the Examiner may have intended to combine Thoma with the Damtrew reference, it is noted, as discussed above, that the Thoma reference does not teach the pressure compensated flow control valves and as such the combination would still not anticipate claims 18 and 19. In the event however

that the Examiner seeks to maintain a rejection of claims 18 and 19 on the basis of the combination of Damtrew, Thoma and Okuda, it is appropriate that the finality of the present Office Action be withdrawn and a new Office Action issued specifically setting forth that rejection with respect to claims 18 and 19.

The Examiner has also rejected claims 43 through 46, 53 and 54 in view of the teachings of Bethke in view of Blasutta. The Examiner notes that Bethke does not disclose the rolling of abutments across the end faces and therefore relies upon the teachings of Blasutta to provide such a teaching. As discussed above, the Applicants position is that Blasutta does not teach the rolling of the convex abutments across the end faces of the motors and accordingly, the combination of Bethke with Blasutta does not teach the invention set forth in claim 43 and the claims dependent thereon.

It is believed therefore the present application is in order for allowance and further consideration to that end is respectfully requested.

Respectfully submitted,

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Annotated Marked-Up Sheet
Application No. 11/776,771
SSJR File 4095-P0010A

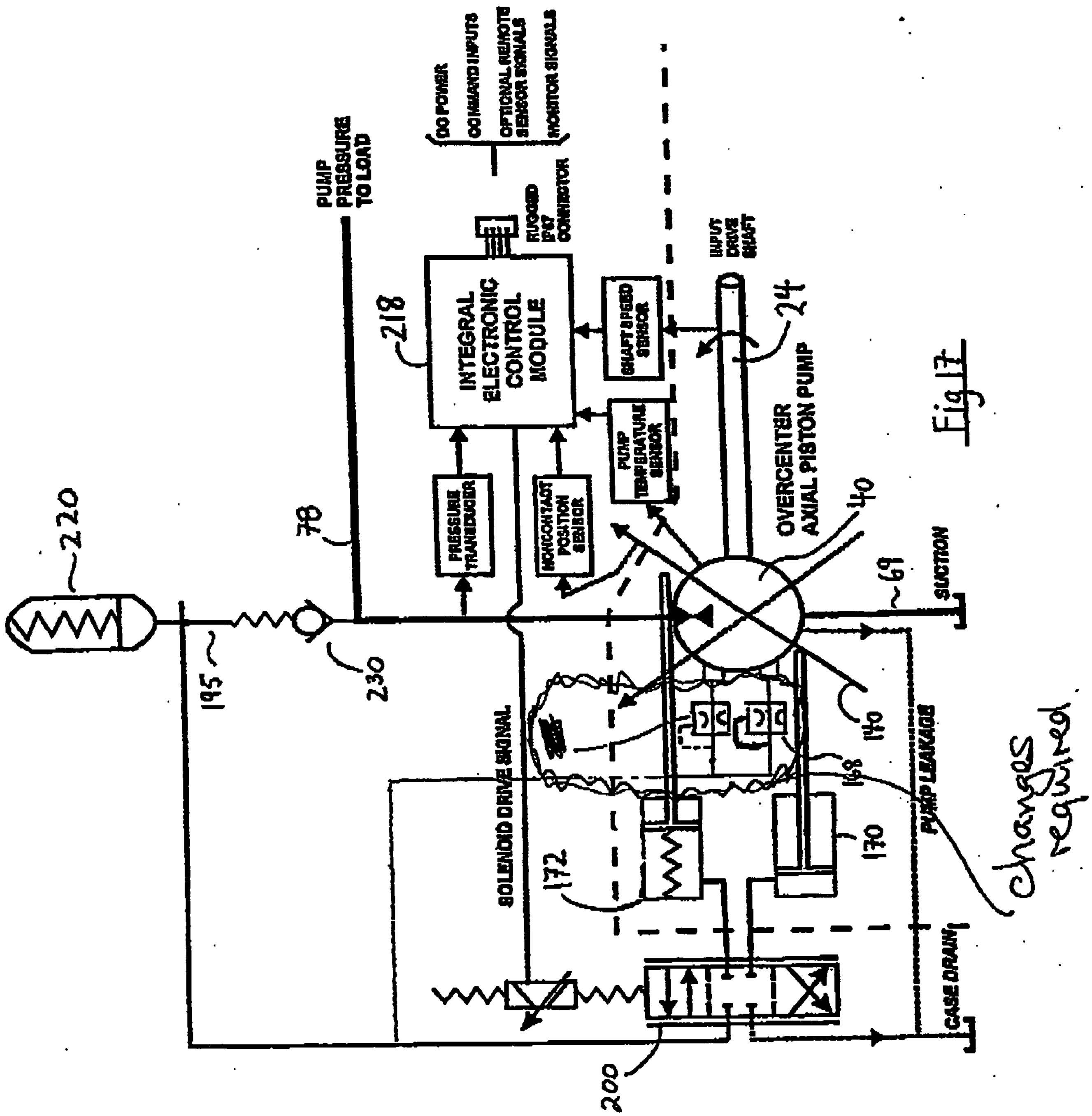

Fig 17